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Statistical Analysis of the Effectiveness of the New Cooperative Medical Scheme in Rural China

ANALYSE EN STATISTIQUE SUR L'EFFICACITÉ DU NOUVEAU DISPOSITIF DU COOPÉRATIF MÉDICAL DE LA CHINE RURALE

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Abstract: This study is aimed at evaluating the impact of China's New Cooperative Medical Scheme (NCMS) on the utilization of health service and health status. Using a large sample based on the China Health and Nutrition Survey (CHNS) data and both Instrument Variables and individual Fixed Effect methods to eliminate the potential endogeneity problem, we consistently found that being enrolled by NCMS reduces out-of-pockets expenditure of rural residents of China. There's also a weaker evidence that the enrollment increase the use of preventive health service. However, we found that Enrolled in NCMS neither improves health condition nor increases the utilization of preventive and formal health service.
Key words: New Cooperative Medical Scheme; Health service; Rural residents; Statistical Analysis

Résumé: Cette étude vise à évaluer l'impact de la Chine Nouvelle coopérative médicale Scheme (SNGC) sur l'utilisation des services de santé et l'état de santé. L'utilisation d'un large échantillon basé sur la Santé de la Chine et la nutrition Enquête (ISC) des données et des variables instrumentales et individuels à la fois des méthodes à effet fixe pour éliminer le problème d'endogénéité, nous avons constamment trouvé que étant inscrits par SNGC réduit out-of-poches des dépenses des résidents ruraux de la Chine. Il ya également une faible preuve que l'inscription d'accroître l'utilisation des services de santé préventifs. Toutefois, nous avons constaté que ni inscrits dans le SNGC améliore l'état de santé, ni l'augmentation de l'utilisation des services de santé préventifs et formelle.
Mots clés: Nouveau système de coopérative médicale; Le service de santé; Les résidents ruraux; D'analyse statistique

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INTRODUCTION

In the 1990s China's long-standing Cooperative Medical Scheme (CMS) collapsed as the country's economic system moved from a planned economy to a socialist market model (Mao, 2005). The financial obstacles caused by the lack of insurance impede the rural residents in trying to get access to essential health care services and making them extremely vulnerable in case illness strikes a household member (Hendrik, Van, 2006).

In an effort to solve the problems, China launched the New Cooperative Medical Scheme (NCMS) in late 2003, a new medical insurance system for rural area. Recent years saw a dramatic expansion of the coverage. Beginning with only 310 rural counties in 2004 (Mao, 2005), the coverage had expanded to 2451 counties by the end of 2007, accounting for 86% of all rural counties in China (lei and Lin, 2009).

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However, the question remains whether 'being insured' would result in increased utilization of health care, decreased financial burden and improvement in health condition. For example, it is possible that the reimbursement is not enough to make a significant dent in households' out-of-pocket spending (wagstaff, 2008). This paper is aimed at shedding lights on the effectiveness of the NCMS by investigating whether the NCMS reduced financial burden, improved health status, and increased access to health care.

This study will utilize the China Health and Nutrition Survey (CHNS), an ongoing international collaborative project between the Carolina Population Center and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention. Using six waves of the CHNS survey, we attempt to identify and compare the causal effects of CMS and NCMS on health status, on utilization of health care service and on out-of-pocket expenditure.

This study will start with a pooled OLS as the benchmark model. To overcome the problem of endogenity, we'll use whether an individual is living with his/her mother or father as the instruments for the individual's health insurance status. Furthermore, taking advantage of the panel nature of the CHNS data, we also used the fixed effect estimation.

Employing the two strategies, we consistently found that the NCMS has a positive effect on reducing out-of-pockets expenditure. In addition, self-reported health status is positively correlated with being covered by NCMS. However, there's no evidence that NCMS increases the utilization of preventive and formal health service.

1. RELATED LITERATURES

Many studies have examined the relationship between health insurance and health status in developed countries. These studies have been well summarized by Levy and Meltzer 2001 and Hadley 2003. Most suggested that there are significant positive effects of health insurance on self-reported health status (Franks, Clancy et al. 1993; Hadley 2003; Card, Dobkin et al. 2004; McWilliams, Zaslavsky et al. 2004; Hadley and Waidmann 2006). On the other hand, several studies have found that health insurance coverage is not associated with health status, and some have even found it to be associated with worse health status (Hadley, 2003).

An increasing attention has been paid to the cast of China, especially the NCMS. Mao 2005) and (Zhu and Zheng, 2007) both gave a detailed description on the design and implementation of NCMS; Brown et al. (2008) explored the variations in the design of the NCMS programs across different counties and conclude that the NCMS is in general favored by most rural residents and is successful.

Van. Dalen (2005) investigated the health care demand in China using the 2004 wave of CHNS data. He found that health insurance does not affect health care demand in a significant manner. However, the study did not distinguish between urban and rural area of China and has no attempt to control for endogenity.

Wagstaff et al. (2009) conducted a survey in 10 counties that had implemented the NCMS and then compared the outcomes of these 10 counties with those of five other counties that had not implemented the NCMS pilot program. They found that enrollment was lower among poor households and higher among households with chronically sick members. They also found that the NCMS had increased overall utilization of inpatient and outpatient services, but that this utilization was disproportionately higher in healthier households.

Lei and Lin (2009) conducted the study most relevant to this paper. Using the 2000, 2004 and 2006 waves of CHNS data, they explored the impact of the NCMS on health, utilization of preventive care, formal medical care and traditional Chinese folk doctors, and on out-of-pocket expenditure. They also employed individual fixed-effect models, instrumental variable estimation, and difference-in-differences estimation with propensity score matching to correct the potential selection bias. They found that participating in the NCMS decreases the use of traditional Chinese folk doctors and increases the utilization of preventive care. However, they did not find that the NCMS decreases out-of-pocket expenditure nor increases utilization of formal medical service or improves health status.

2. EMPIRICAL FRAMEWORK

We began the study by using a pooled Ordinary Least Squared method (Logit model for binary dependent variables):

$$Y_i(or \cdot Logit(Y_t)) = \alpha_0 + \alpha_1 NCMS_i + \alpha_2 X + \varepsilon_i$$

Where *NCMS* is an indicator of whether one has been enrolled in NCMS. X's are control variables including age, sex, education, family income, family size and so on. As indicated, dependent variables are measurement of health status and health utilization. Specifically, for health status, we created an indicator which is 1 when people responded as "good or excellent" health condition and 0 otherwise. Since it's a binary dependent variable, we use Logit estimation.

The other two binary dependent variables are indicators of whether utilizing preventive and formal health service during past 4 weeks. However, there's no direct source of formal medical service before the 2004 wave of CHNS data.

Fortunately, the data on people's choice when they felt ill is available for all waves. Therefore, we define seeing a doctor when felt ill as utilizing formal medical service.

Finally, the out-of-pockets expenditure on medical service is a good measure of the effectiveness of health insurances. However, the CHNS data sets contain too many missing values. An OLS regression of out-of-pockets expenditure on insurance coverage and other control variables contains only roughly 200 observations. Given the fact that less than 1% of the data are included in the regression, it is not convincing to use the out-of-pockets expenditure as a dependent variable.

Instead, we use the natural log of household income-expenditure ratio as the proxy variable for out-of-pockets expenditure. Specifically, we divided the real annual total household income by real annual total household expenditure and get the income-expenditure ratio. Next we take the natural log of the ratio since the ratio is not normally distributed.

Even after controlling for detailed set of controls, the problem of endogeneity may still not be eliminated. There are two possible reasons for this study. First, people who enroll themselves in the NCMS may have other unobservable characteristics that affect both their enrollment decisions and their service utilization or health status (Lei and Lin, 2009). For example, consider the case when we estimate an OLS model in which the dependent variable is the indicator of seeing a doctor when felt ill and one of the independent variable is the NCMS enrollment. However, it is possible that some individuals are superstitious and don't trust the doctors in the hospital. These people are less likely to go to hospital when they are ill. But these people are also unlikely to participate in the NCMS. Since the information on whether an individual trust modern medicine or not is unobservable but correlated with both the dependent variable and the independent variable, OLS estimation will be biased.

The other possibility is adverse selection. It is true that the NCMS required family participation in the purpose of eliminating adverse selections; however, studies have shown that this mechanism may not avert the occurrence of adverse selection (Zhang, 2005; He, 2005 and Shen, 2004). Therefore, our sample will not be random and the OLS estimation will again be biased.

To overcome the problem of endogenity, we first use the Instrument variables method. The two instruments are whether living with father and whether living with mother. There are two requirements for the instruments to be valid. The first requirement is the existence of a high correlation between whether an individual is participating in the NCMS and whether he/she lives with their father or mother. A simple regression in which NCMS was regressed on whether living with father or mother shows that there's a strong correlation. In addition, the first-stage F statistics in all IV regressions are large and all p-values are smaller than 5%.

In addition to the IV method, we also use the individual FE method and control for characteristics specific to each individual that are constant over time. If unobservable characteristics remain constant over time, individual FE estimation can overcome the endogeneity problem.

3. DATA

This study is based on the China Health and Nutrition Survey (CHNS). The CHNS is an ongoing international collaborative project between the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention. It was designed to examine the effects of the health, nutrition, and family planning policies and programs implemented by national and local governments and to see how the social and economic transformation of Chinese society is affecting the health and nutritional status of its population. The first round of the CHNS, including household, community, and health/family planning facility data, was collected in 1989. Six additional panels were collected in 1991, 1993, 1997, 2000, 2004 and 2006. The surveys were performed using a multistage random cluster process to draw a sample from nine provinces covering the east, middle and west areas in china. The data set of CHNS involves detailed information on demographics, socio-economic variables, individual health care indicators, medical care expenses etc. To gain an insight in the Chinese demand for health insurance over time by means of the CHNS, one can consult studies by Henderson et al. (1995), Akin et al. (2004) and Lindelow and Wagstaff (2005).

Given the fact the 1989 wave of data contains little information on health insurance, this study will use the rest six waves of data and focus only on households members that live in rural area of China. After dropping observations with missing values on key variables such as age, education etc., we end up with a final pool of 58,082 observations.

The key dependent variables are the following: choice of medical service when felt ill; self-reported health status and use of preventive health service.

4. RESULTS AND ANALYSIS

Table 1 shows the estimation results of "enrolled in NCMS" on self-reported health status. The dependent variable is a binary indicator of 1 being in good or excellent condition. Column 2 shows the marginal effects of Logit model; Column 3 includes the results of IV estimation and column 4 provides individual fixed effects estimation results. All three models show that enrolled in NCMS is positively correlated with being in good health condition. However, only the coefficient in the FE model is statistically significant. So there's no enough evidence that being enrolled in NCMS improves health conditions of enrollees. In addition to the NCMS variable, we can see that people with higher age and those who were sick are, as expected, less likely to be in good health condition. Also, males and those who are responsible for household farming are more likely to be in good health.

Table 1: Regressions of Self-reported Health Condition on NCMS Coverage[b]

Dependent Variable: 1= in good or excellent health condition	Logit[a]	IV	Individual Fixed Effects
1=enrolled in ncms	0.00513 (0.0169)	1.007 (2.682)	0.0301** (0.0144)
Family size	-0.0131***(0.00424)	0.00150 (0.0421)	-0.00637 (0.00388)
Age	-0.0125***(0.00299)	-0.00717**(0.00318)	-0.00667**(0.00261)
Age square	0.0000421(0.000033)	-0.000019(0.000042)	-0.000018 (0.00003)
1=married	0.0121 (0.0187)	-0.00752 (0.0460)	0.00326 (0.0163)
1=male	0.0541*** (0.0172)	0.0463*** (0.0180)	
Being employed (not self employed)	0.0149 (0.0245)	-0.0740 (0.233)	0.0138 (0.0203)
Responsible for hh farming	0.0315** (0.0124)	0.0308* (0.0167)	0.0276** (0.0111)
Sick or injured last 4 weeks	-0.413*** (0.0183)	-0.412*** (0.0715)	-0.375*** (0.0164)
Ever smoked	0.00398 (0.0155)	0.0237 (0.0558)	0.00520 (0.0136)
Log of hh income	0.0118 (0.00803)	-0.0315 (0.116)	0.00973 (0.00730)
Log of individual income	0.0226*** (0.00689)	0.00974 (0.0264)	0.0143** (0.00606)
Observations	8542	8362	8536

[a]Marginal Effects reported for Logit Regression;
[b]Robust standard errors in parentheses;*** p<0.01, ** p<0.05, * p<0.1
Some explanatory variables, including the constant are not reported.

Table 2: Regressions of Preventive Health Service on NCMS Coverage[b]

Dependent Variable: 1= enjoyed preventive health service during the past 4 weeks	Logit[a]	IV	Individual Fixed Effects
1=enrolled in ncms	0.0143***(0.00425)	-0.0792 (0.0443)	0.0212***(0.00612)
Family size	-0.000229(0.000362)	-0.00464**(0.00182)	-0.00105(0.00102)
Age	-0.000380(0.000240)	-0.000515(0.000417)	-0.000416(0.00103)
Age square	0.000004(0.00000265)	0.0000076(0.000005)	0.000006(0.000011)
1=married	0.00191(0.00141)	0.00504*(0.00278)	-0.00181(0.00486)
1=male	-0.00523***(0.00185)	-0.00676***(0.00221)	
Being employed (not self employed)	0.000615(0.00165)	0.00864*(0.00451)	-0.00003(0.00581)
Responsible for hh farming	-0.000177(0.000914)	-0.00301(0.00225)	-0.00103(0.00251)
Sick or injured last 4 weeks	0.00609**(0.00253)	0.0168***(0.00503)	0.00853(0.00522)
Ever smoked	-0.000577(0.00137)	-0.00211(0.00186)	0.00142(0.00312)
Log of hh income	-0.00109(0.000784)	0.00368(0.00261)	-0.000879(0.00175)
Log of individual income	0.000879(0.000678)	0.00398***(0.00150)	0.00119(0.00141)
Observations	13889	13832	14095

[a]Marginal Effects reported for Logit Regression;
[b]Robust standard errors in parentheses;*** p<0.01, ** p<0.05, * p<0.1
Some explanatory variables, including the constant are not reported.

Table 2 shows the results of insurance on use of preventive health service. Both Logit and FE models indicate that being enrolled in NCMS increase the use of preventive health care and the effect is statistically significant. It is interesting to see from the IV results that the effect becomes negative while not statistically significant at 5% level. However, it should be aware that it might be not proper to use living with father/mother as the instruments in this situation. As pointed, the instruments might affect the decision of using outpatient health service. If the expenses of preventive health service can be paid by the family saving account, then one might want to give up the chance of having preventive medical service and save the money for the parents.

On the other hand, both Logit and FE models give consistent effect. For the Logit model, being enrolled in NCMS increases the probability of using preventive health service by 1.4% percent; for the FE model, the increase is 3%.

Table 3 reports the effect of being enrolled in NCMS on the choice of seeing a doctor when felt ill. For the Logit, IV and FE models, none of them show a significant effect of the enrollment on the choice of seeing a doctor. This result is consistent with previous studies such as Lei and Lin (2009) and Van Dalen(2005). A possible reason is that the reimbursement only covers a small portion of all inpatient service and the expenses not covered are still unavoidable for the rural citizens. Also, as expected, being sick in past 4 weeks and having a college degree both increase the probability of seeing a doctor.

Table 3: Regressions of seeing a doctor when felt ill on NCMS Coverage[b]

Dependent Variable: 1= seeing a doctor when felt ill	Logit[a]	IV	Individual Fixed Effects
1=enrolled in ncms	-0.0478(0.0394)	0.610(0.640)	-0.0341(0.0378)
Family size	0.0237**(0.0117)	0.0532(0.0344)	0.0224**(0.0111)
Age	-0.00454(0.00892)	-0.00786(0.00988)	-0.00565(0.00855)
Age square	0.000033(0.000092)	0.000042(0.000096)	0.000042(0.000088)
1=married	0.0150(0.0511)	-0.0291(0.0659)	0.0151(0.0500)
1=male	0.000951(0.0474)	0.0392(0.0596)	
Being employed (not self employed)	0.0707(0.0618)	0.000034(0.0888)	0.0593(0.0597)
Responsible for hh farming	-0.0195(0.0334)	0.0210(0.0549)	-0.0139(0.0320)
Sick or injured last 4 weeks	0.218***(0.0383)	0.229***(0.0479)	0.206***(0.0377)
Ever smoked	0.00575(0.0445)	0.00951(0.0499)	0.00907(0.0436)
Log of hh income	0.00629(0.0226)	-0.0464(0.0595)	0.00339(0.0215)
Log of individual income	0.00398	-0.0276	0.00530
Observations	1154	1140	1155

[a]Marginal Effects reported for Logit Regression;
[b]Robust standard errors in parentheses;*** p<0.01, ** p<0.05, * p<0.1
Some explanatory variables, including the constant are not reported.

CONCLUSION AND DISCUSSION

China launched the New Cooperative Medical System (NCMS) in 2003 as a means of addressing inequities in the availability of health care. Numerous studies have investigated the design and implementation of NCMS. However, despite the rapid expansion of its coverage, little attention has been paid to study the effectiveness of the NCMS.

This study is aimed at evaluating the impact of NCMS on the utilization of health service and health status. Using a large sample based on the CHNS survey data and both IV and individual Fixed Effect methods to eliminate selection bias, we consistently found that being enrolled by NCMS reduces out-of-pockets expenditure of rural residents of China. There's also a weaker evidence that the enrollment increase the use of preventive health service. However, we found that Enrolled in NCMS neither improves health condition nor increases the utilization of preventive and formal health service.

Consistent to Lei and Liu (2009)'s study, we did find a weak evidence that being covered by NCMS increases the utilization of preventive health service. The difference is that in their study, the IV estimation also showed a positive correlation between being enrolled in NCMS and use of preventive health service. However, it should be pointed out that the instrument they used may not be valid. As pointed by Mao (2005), in some counties, a free physical check-up is provided to NCMS enrollees each year. Residents living in counties that participate in NCMS may have a better access to preventive health care than those living in counties that are not participating. Therefore, the instrument would be positively correlated with the utilization of preventive health service.

The results of this study should be interpreted with caution. First of all, CHNS data only contains a short time (4 weeks) of information about formal and preventive -health service. Second, self-reported health status may be not accurate. Real health condition may be either overlooked or under looked. In addition, the exogeneity of the instruments used in this study is still questionable. All of the issues above calls for future study.

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